



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/670,894	09/24/2003	Liew Tong Sen	70030599-1	5998
57299	7590	02/05/2008		
Kathy Manke Avago Technologies Limited 4380 Ziegler Road Fort Collins, CO 80525			EXAMINER HUNG, YUBIN	
			ART UNIT 2624	PAPER NUMBER
			NOTIFICATION DATE 02/05/2008	DELIVERY MODE ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

avagoip@system.foundationip.com  
kathy.manke@avagotech.com  
scott.weitzel@avagotech.com

<b>Office Action Summary</b>	<b>Application No.</b> 10/670,894	<b>Applicant(s)</b> SEN ET AL.	
	<b>Examiner</b> Yubin Hung	<b>Art Unit</b> 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 18 December 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-5, 7-13, 15-21 and 23-29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7-13, 15-21 and 23-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>12/18/07</u> . | 6) <input type="checkbox"/> Other: _____  |

***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 12/18/07 has been entered.

***Information Disclosure Statement***

2. The information disclosure statement (IDS) submitted on 12/18/07 was filed after the mailing date of the notice of allowance on 09/19/07. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

***Allowable Subject Matter***

3. The indicated allowability of claims 1-5, 7-9, 11-13, 15-21 and 23-29 in the Office action mailed 06/14/07 is withdrawn in view of new grounds of rejections; see below.

**(Note: the detailed action below is taken with reference to  
the 09/10/07 amendment.)**

***Claim Objections***

4. Claims 1, 10, 12, 17 and 19 are objected to because of the following informalities:

- Claim 1, line 4: consider changing “a plurality of composite images” to “the plurality of composite images” (per Fig. 1, ref. 125 of the instance specification);  
**do the same for claim 12 (line 9)**
- Claim 1, line 6: consider changing “said reference images” to “previously stored reference images” (per Fig. 1, ref. 130 and Fig. 4, ref. 530 of the instance specification; note that if comparison is made between reference images and composite images from the same input image, it is hard to see how any motion can be detected); **do the same for claim 12 (line 11)**
- Claims 10 and 17, respective line 1: consider changing “said motion values comprise” to “each said preliminary motion values comprises”
- Claim 19, line 6: consider changing “reference composite images” to “previously stored reference composite images” (per Fig. 1, ref. 130 and Fig. 4, ref. 530 of the instance specification; note that if comparison is made between reference

images and composite images from the same input image, it is hard to see how any motion can be detected)

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. Claim 1, and similarly claims 9 and 12, recites the limitation "said composite images" in line 6. Since "composite images" appear both in lines 3 and 6, it is not clear which one is being referred to, ambiguity arises and the metes and bounds of the claim cannot be ascertained. Claims 2-11 and 13-18 are similarly rejected since they inherit the same ambiguity. [Note: in the 09/10/07 response applicant argued that "Some composite images are stored as reference images. Composite images are also compared to the reference images. Therefore, the use of 'composite images' in the claim is correct." This is not persuasive since as there can be composite images that

are not stored as reference images, it is not clear whether the "said composite images" refer to the those composite images stored as reference images or those that are not stored as reference images. This rejection can be overcome if claims 1 and 12 are amended as suggested in the Claim Objection section above.]

8. Claim 9, and similarly claim 16, recites the limitation "said reference composite images" in lines 2-3. There is insufficient antecedent basis for this limitation in the claim.

### ***Claim Rejections - 35 USC § 102***

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 1, 7, 8, 19-21, 23, 24, 26 and 27 are rejected under 35 U.S.C. 102(b) as being anticipated by Fuji et al. (US 2002/0057736).

11. Regarding claim 19 Fuji discloses

- receiving an input image  
[Fig. 3, ref. 12a; paragraph 52]

- decomposing said input image into a plurality of composite images that comprise different frequency bands of said input image  
[Fig. 3, ref. 12b; Fig. 4; paragraphs 52-64]
- comparing said composite images with reference composite images to produce preliminary motion values for said different frequency bands  
[Fig. 3, especially ref. 12f and P. 3, paragraphs 51-58, especially 57 (compare with reference); Fig. 5 and P. 4, paragraphs 65-67]
- determining a final motion value from said preliminary motion values  
[Fig. 5 and P. 4, paragraphs 65-67 (especially paragraph 67, lines 6-13). Note that the preliminary motion value corresponding to the band that has the highest similarity (a measure of matching result) is determined as the final motion value]
- wherein said determining step compares said preliminary motion values from said different frequency bands to determine differences based on features repeating at different regularities in the spatial domain  
[P. 4, paragraph 67, especially lines 6-13. Note that the difference determination is based on features repeating at different regularities in the spatial domain because regularly repeated features (if present; not always guaranteed as applicant clearly is aware of as per P. 18, lines 9-10 of the specification) are reflected in motion values detected by matching]

12. Regarding claim 1 Fuji discloses a device comprising a decompose (or transform) logic [Fig. 3, ref. 12b], a storage coupled to the transform logic [Fig. 3, ref. 12h; P. 3, paragraph 56], a comparison logic and a logic to determine a final motion value [Fig. 3, ref. 12f (serves as both the comparison and the motion determination logic); Fig. 5; also P. 3, paragraphs 51-58, especially 57 (compare with reference) and P. 4, paragraphs 65-67 (especially lines 6-9 of paragraph 67)]. Note further that per the analysis of claim 19, the recited functions are carried out by the respective logics.

13. Regarding claim 23, and similarly claim 7, Fuji further discloses

- wherein said determining step modifies preliminary motion values associated with a frequency band of said different frequency bands.  
[P. 4, paragraph 67. Note that since the only one final motion vector (or value) is used as the motion vector of the entire image, the preliminary motion vectors associated with the various frequency bands are considered thus modified]
- wherein repetitive features are reduced  
[Figs. 4 & 9, also P. 6, paragraph 83, especially lines 5-7. Note that low-pass filters used in wavelet transform reduces repetitive features (of frequency higher than allowed by the filter). (Note further that the act of modifying preliminary motion values has no effect on the image and therefore does not reduce repetitive features.)]

14. Regarding claim 24, and similarly claim 8, Fuji further discloses

- wherein said decompose logic comprises a plurality of filters having different frequency characteristics from each other  
[Fig. 9 and P. 6, paragraph 83, especially lines 5-7]

15. Regarding claim 20, note that Fuji [Figs. 4 & 9 and P. 6, paragraph 83] further discloses recursive application of a discrete wavelet transform.

16. Regarding claim 21, note that Fig. 9 of Fuji further discloses sub-images (e.g., LH and HL, which are images themselves) resulted from the DWT decomposition having different frequency bands in the x- and the y-components (using  $H_1$  and  $H_0$ , which are high- and low-pass filters, respectively).

17. Claim 26 is rejected because per the analysis of claim 19, in the determination of the final motion value the value from the band with the highest similarity is selected [Fuji: P. 4, paragraph 67, lines 6-9]; in other words, the weight for the motion value from the band with the highest similarity is 1 and the weights for all other motion values are 0.

18. Claim 27 is rejected because (per the analysis of claim 26) while the possible weight values are 0 or 1, the assignment of the weights (to the motion values from different bands) varies from image to image (because a band, say  $LH_2$ , in one image that produces the highest similarity may not be the same highest-similarity-value-



producing band in another image); therefore the weighting values for the motion values from the bands are determined dynamically (i.e., changes from image to image).

***Claim Rejections - 35 USC § 103***

19. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

20. Claims 2-5, 9, 12, 13, 15, 16 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fuji et al. (US 2002/0057736) as applied to claims 1, 7, 8, 19-21, 23, 24, 26 and 27 above, and further in view of Kroos et al. (US 6,931,145).

21. Regarding claim 12, per the analysis of claims 1 and 19 Fuji discloses a decompose (i.e., transform) logic, a storage, a comparison logic and a logic to determine a final motion value). Additionally, Fuji further discloses

- wherein said transform logic produces images in which an "x" component and a "y" component comprise different frequency bands from each other, wherein repetitive features in the x-axis or y-axis of said input image are selectively filtered  
[Figs. 4 & 9, also P. 6, paragraph 83, especially lines 5-7. Note that the x- and the y-components of each of the images labeled as LH or HL comprise different frequency bands from each other. Note further that low- and high-pass filters used in wavelet transform reduces repetitive features (of frequencies outside the respective ranges allowed by the filter)]

Fuji does not expressly disclose the following, which is disclosed by Kroos:

- an image sensor  
[Fig. 2, ref. 30; Col. 5, lines 31-32]

Fuji is combinable with Kroos because they both have aspects that are from the same field of endeavor of motion estimation.

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify Fuji with the teaching of Kroos by using a sensor to obtain the invention as specified in claim 12. The reason for doing so would have been because video acquisition devices (e.g., camcorders) have been in wide use and it would have been beneficial to have the coding device of Fuji (e.g., via the input of Fig. 3) to be part of such a device in order to reduce the amount of data.

22. Regarding claim 2, and similarly claim 13, Kroos further discloses

- said decompose logic performs a redundant Discrete Wavelet Transform [Fig. 13; Col. 8, lines 10-21 (note that no sub-sampling is carried therefore the transform is redundant). Note that the reason for using redundant DWT would have been to obtain more accurate motion values since down-sampling has not been performed and therefore the resolution has not been reduced, as one of ordinary skill in the art at the time of the invention would have known]

23. Regarding claims 3-5, the combined invention of Fuji and Kroos further discloses decomposing an image in such a manner as to produce images of which the x- and the y-components comprise frequency bands that are different from each other (claim 3) as well as frequency bands that are the same (claims 4 and 5) [Kroos: Fig. 13 and Col. 8, lines 10-31; note that the x- and the y-components of each of the images labeled "Approximation" (commonly referred to as LL) have the same frequency band and for

those labeled as "Subband" (commonly referred as LH or HL) the frequency bands are different.]

24. Regarding claim 9, and similarly claims 16 and 25, the combined invention of Fuji and Kroos further discloses

- wherein said comparison logic performs a cross-correlation on a subset of pixels between said composite images with said reference composite images  
[Kroos: Fig. 7, ref. 154 (correlation); Col. 9, lines 58-61 (cross correlation using texture map, i.e., a subset of pixels); Col. 10, lines 30-42 (performed for each sub-band). Note that the reason for using cross correlation would have been because for picture matching cross correlation is as form of minimum-error decision making, as is well known in the art (e.g., see P. 44, 2<sup>nd</sup> paragraph of Rosenfeld and Kak's *Digital Picture Processing*, 2<sup>nd</sup> ed., vol. 2, 1982, which is used to show the general knowledge and is not relied upon for the rejection)]

25. Regarding claim 15, Fuji further discloses

- wherein said logic to determine a final motion value attenuates preliminary motion values associated with a frequency band of said different frequency bands  
[P. 4, paragraph 67. Note that since the preliminary motion value corresponding to the band that has the highest similarity is determined as the final motion value, the preliminary motion values of the rest of the frequency bands are not incorporated (i.e., attenuated to zero)]
- wherein repetitive features are reduced  
[Figs. 4 & 9, also P. 6, paragraph 83, especially lines 5-7. Note that low-pass filters used in wavelet transform reduces repetitive features (of frequency higher than allowed by the filter). (Note further that the act of attenuating preliminary motion values has no effect on the image and therefore does not reduce repetitive features.)]

>>><<<

26. Claims 10 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fuji et al. (US 2002/0057736) and Kroos et al. (US 6,931,145) as applied to claims 2-5, 9, 12, 13, 15, 16 and 25 above, and further in view of Khansari et al. (US 6,141,448) and Astle (US 6,529,613).

27. Regarding claim 10, Fuji discloses all limitations of its parent, claim 1.

Fuji does not expressly disclose the following, which is disclosed by Khansari and Astle:

- wherein said motion values comprise an x-motion value and a y-motion value and said logic to determine a final motion value weighs said x-motion value differently from said y-motion value [Khansari: Col. 9, line 17-Col. 10, line 63, especially Col. 10, lines 42-63 (obtaining a motion value estimate by weighting motion values from different bands); Astle: Col. 18, lines 5-49 (weighing x- and y-motion values differently)]

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify Fuji with the teaching of Khansari and Astle as recited above to obtain the invention as specified in claim 10. The reasons for doing so would have been to prevent extensive error propagation in decoded picture frame sequence (as Khansari indicates in Col. 10, lines 42-44) as well as to be able to handle interlace aliasing (if the frame are interlaced) (as Astle indicates in Col. 18, lines 44-47).

28. Regarding claim 17, the combined invention of Fuji and Kroos discloses all limitations inherit from its parent, claim 12. The limitation specific to claim 17 is taught by Khansari and Astle as per the analysis and rejection of claim 10 above.

>>><<<

29. Claims 11 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fuji et al. (US 2002/0057736) as applied to claims 1, 7, 8, 19-21, 23, 24, 26 and 27 above, and further in view of Zafar et al. ("Multiscale Video Representation Using

Multiresolution Motion Compensation and Wavelet Decomposition," IEEE J. Selected Areas in Communications, V. 11, No. 1, Jan 1993, pp. 24-35).

30. Regarding claim 11, and similarly claim 28, Fuji discloses all limitations of its parent, claim 1.

Fuji does not expressly disclose the following, which is taught by Zafar

- wherein said decompose logic performs a quantization with a pre-determined threshold [P. 26, right column, lines 1-9, especially lines 8-9]

Fuji is combinable with Zafar because they both have aspects that are from the same field of endeavor of motion estimation.

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify Fuji with the teaching of Zafar as recited above. The reason would have been to reduce the number of coefficients to be further quantized as well as for the simplicity (when using a fixed, i.e., pre-determined, threshold), as Zafar indicates in lines 1-9 on the right column of page 26.

Therefore, it would have been obvious to combine Zafar with Fuji to obtain the invention as specified in claim 11.

>>><<

31. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fuji et al. (US 2002/0057736) and Kroos et al. (US 6,931,145) as applied to claims 2-5, 9, 12-16 and 25 above, and further in view of Zafar et al. ("Multiscale Video Representation Using Multiresolution Motion Compensation and Wavelet Decomposition," IEEE J. Selected Areas in Communications, V. 11, No. 1, Jan 1993, pp. 24-35).

The combined invention of Fuji and Kroos does not expressly disclose the following, which is taught by Zafar

- wherein said transform logic performs a quantization with a pre-determined threshold [P. 26, right column, lines 1-9, especially lines 8-9]

The combined invention of Fuji and Kroos is combinable with Zafar because they both have aspects that are from the same field of endeavor of motion estimation.

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify the combined invention of Fuji and Kroos with the teaching of Zafar as recited above. The reason would have been to reduce the number of coefficients to be further quantized as well as for the simplicity (when using a fixed, i.e., pre-determined, threshold), as Zafar indicates in lines 1-9 on the right column of page 26.

Therefore, it would have been obvious to combine Zafar with Fuji and Kroos to obtain the invention as specified in claim 18.

>>><<<

32. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fuji et al. (US 2002/0057736) as applied to claims 1, 7, 8, 19-21, 23, 24, 26 and 27 above, and further in view of Rovati et al. (US 7,099,512).

33. Regarding claim 29, Fuji discloses all limitations of its parent, claim 19.

Fuji does not expressly disclose performing the method of claim 19 in an optical mouse.

However, Rovati discloses an optical mouse with motion detection capability [Fig. 1; Col. 3, lines 37-55].

Fuji is combinable with Rovati because they both have aspects that are from the same field of endeavor of motion estimation.

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify Fuji with the teaching of Rovati as recited above to obtain the invention as specified in claim 29. The reason would have been because for an optical mouse it is necessary to be able to determine the motion imparted by the user from the generated frames, as Rovati indicates in Col. 1, lines 13-27.

***Conclusion and Contact Information***

34. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- Carrasco et al. (US 2005/0031037) – discloses motion detection using redundant DWT and combining MVs from different bands
- Laurent-Chatenet (US 2003/0063672) – disclose linearly combining MVs using different weights
- Weiss et al. (US 5,557,341) – discloses linearly combining MVs (each acquired from different frame pairs) using different weights

35. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yubin Hung whose telephone number is (571) 272-7451. The examiner can normally be reached on 7:30 - 4:00. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew C. Bella can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



36. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Yubin Hung  
Patent Examiner  
Art Unit 2624

January 28, 2008

A handwritten signature in black ink, appearing to read 'Yubin Hung', is written over the printed name and title.